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LENIN PRIZES FOR 1966

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THE Lenin Prize for 1966 was awarded to A. A. Abrikosov, L. P. Gor'kov, and V. L. Ginzburg for developing a theory of superconducting alloys and properties of superconductors in strong magnetic fields. The theory created by them together with L. D. Landau, known in the whole world as the GLAG (Ginzburg-Landau-Abrikosov-Gor'kov) theory, is the basis for the majority of modern research in superconductivity. One of the most important conclusions of this theory is the predicted existence of alloys whose superconducting state is not destroyed by magnetic fields up to hundreds of thousands of Oe. The discovery of such superconductors—called superconductors of the second kind—was of tremendous significance both for physics and for engineering, since it led to the creation of "superconducting magnets"—solenoids with superconducting windings. The dimensions and power consumption of such a magnet are incomparably smaller than those of an ordinary electromagnet designed for the same field (~ 100 kOe). The GLAG theory has helped explain also other subtle and very important physical phenomena connected with the structure of the superconducting state in strong magnetic fields and with the phenomenon of superconductivity in alloys, and the possibilities of this theory are undoubtedly still far from exhausted.

The Lenin Prize for theoretical and experimental research on excitons in crystals was awarded to two groups of physicists: E. G. Gross, B. P. Zakharchenya, and A. A. Kaplyanskiĭ in Leningrad, and A. S. Davydov, A. F. Prikhot'ko, V. L. Broude, A. F. Lubchenko, M. S. Brodin, and É. I. Rashba in Kiev.

The idea of the exciton, first advanced by Ya. I. Frenkel for the interpretation of the mechanism of absorption of light by crystals, turned out to be exceedingly flexible and fruitful. The greatest success was obtained in the application of this idea to crystals of the semiconductor type (Cu_2O, CdS) in the papers of E. F. Gross and co-workers and to molecular crystals of aromatic compounds (benzene, naphthalene, anthracene) in the work of A. F. Prikhot'ko, A. S. Davydov and their co-workers. In either case, the collective effects due to the regular arrangement of the molecules in the crystals lead to the occurrence of unique absorption spectra, belonging to the crystal as a whole. In the case of semiconducting crystals (Cu_2O) these phenomena are manifest in the occurrence of a hydrogenlike spectrum situated on the edge of the intrinsic absorption of the crystal. A detailed investigation of this spectrum and proof that it belongs to a quasiparticle (exciton) are due to the group headed by F. G. Gross. These investigations have been exhaustively described in our journal (E. F. Gross, UFN **63**, 575 (1957) and also UFN **76**, 433 (1962), Soviet Phys. Uspekhi **5**, 195 (1962)).

In the case of molecular crystals of aromatic compounds, the excitation wave propagating through the crystal, and the quasiparticle (exciton) corresponding to it lead to the appearance in the absorption spectra of singular lines that are strongly polarized in the direction of the crystallographic axes. An experimental investigation of these crystal spectra was carried out by A. F. Prikhot'ko and V. L. Broude; further development of the theory of excitons in molecular crystals is due to A. S. Davydov and É. I. Rashba, In particular, Davydov predicted theoretically that in those cases when there are two molecules per unit cell of the crystal, the spectral lines split into two components polarized in accordance with symmetry properties of the crystal. This splitting, confirmed by experiment, is called in the literature "Davydov splitting." It represents splitting of nondegenerate levels of identical regularly arranged molecules under the influence of mutual perturbations, i.e., a collective effect, unlike the previously investigated splitting of degenerate levels of the atoms themselves and of the molecules themselves under the influence of internal electric fields of the crystal (the so-called "Bethe splitting").

Work on excitons in molecular crystals were also reported many times in this journal (V. L. Broude, A. F. Prikhot'ko, and É. I. Rashba, UFN **67**, 99 (1959), Soviet Phys. Uspekhi 2, 38 (1959); V. L. Broude, UFN **74**, 577 (1961), Soviet Phys. Uspekhi **4**, 584 (1962); A. S. Davydov, UFN **82**, 393 (1964), Soviet Phys. Uspekhi **7**, 145 (1964)).

Translated by J. G. Adashko